Chapter 2 – Alternatives

This chapter presents the different build alternatives that address the purpose and need presented in Chapter 1. This chapter also presents the No Action Alternative as required by NEPA. In order to fully understand these alternatives and their effects, some background information is provided on how these alternatives were developed, as well as a brief explanation of the different types of actions that serve as components within each of the build alternatives. Then all alternatives to be analyzed in Chapter 3, including the No Action Alternative, are presented and described. Following the description of the alternatives is a discussion of the typical sections for the alternatives, which provides the reader an idea of the size of the proposed structures. The last section of the chapter discusses alternatives that were considered but eliminated from further analysis.

A. Background

1. Alternative Development

Given that multiple portions of roads in the project area were identified as RAADs, the project area was divided into four "Zones" that are based on the direction from which the rising waters of Devils Lake pose a threat to the roads. Within each of these zones, different build alternatives were developed. The four zones are identified on **Figure 2-1** and include Zones, 1, 2, and 3 in the St. Michael area and Zone 4 for Acorn Ridge.

Given that there are multiple RAADs that must be addressed in each zone, the components for each alternative within a zone must be consistent. For example, construction of a road as a dam on the eastern end of one zone may necessitate a perimeter dam in the western portion of that same zone to prevent water from entering lower elevations from the west.

It is also important that the alternatives identified in each zone are consistent with one another. Due to geography and project scope, Zone 4 is discrete from the other three zones and, therefore, the course of action for Zone 4 has no effect on Zones 1, 2, and 3. The converse is also true. However, because Zones 1, 2, and 3 are adjacent to one another, the development of the build alternative in each zone must complement the alternatives in the other zones.

The Preferred Alternative for each zone will be noted in the description. When an alternative is identified as "Preferred" this means that this is the current course of action that the PDT has decided to pursue after receiving input from the stakeholders including the public and various agencies and organizations through the NEPA process. Identification of the Preferred Alternative was based on a review of impacts, costs, and construction feasibility as well as input from the PDT and PST.

Figure 2-1. Project Area Zones

2. Types of Actions Included in the Alternatives

The interagency task force discussed in Chapter 1 identified a number of different types of actions that could address the threats posed by the RAADs. These actions include raising and building the roads as dams, raising and equalizing the roads, building perimeter dams that connect high ground, which would protect the transportation network, and building dams parallel to the roads. SAFETEA-LU directed the FHWA to consider these actions identified by the interagency task force.

The PDT reexamined the actions identified by the task force, refined them, included other actions not considered by the task force such as realignment, and developed alternatives for each zone that included a combination of these actions. Each action is described below.

a) Raise and Construct a Project Road as a Dam

Under this action, a project RAAD would be raised and constructed to contain the features critical to dams. This work would need to meet all state and federal dam safety requirements and be approved by the appropriate dam-building agency. The safety requirements include the following:

- The dam, foundation, and abutments must be stable under all lake levels, both static and dynamic.
- The seepage through the embankment and foundation must be controlled and collected.
- The freeboard must be sufficient to prevent overtopping by waves and include an allowance for foundation settlement.
- An operation and maintenance manual must be prepared.
- A monitoring and surveillance plan must be implemented that includes adequate instrumentation.
- The documentation of all design, construction, and operational records must be kept for review.
- An emergency action plan must be developed.
- A schedule for periodic inspections and comprehensive review and evaluation must be prepared allowing for modifications to the dam if needed.

The safety requirement involving freeboard requires further clarification. Freeboard is extra height that an embankment must have above a lake's still-water elevation in order to accommodate wave action and flood events. With regard to Devils Lake, should the Lake rise to outlet into the Sheyenne River at 1,459 feet, the western side of the Lake would rise above 1,459 feet; until enough pressure is built up to force water out of the outlet at a faster rate than water is entering Devils Lake. This incremental rise above the outlet elevation of 1,459 feet is the still water elevation for the Lake, which, for this document, is considered to be 1,460 feet. The PDT determined that eight feet of freeboard (five feet for wave action and three feet for flood events), are required above this still water elevation to safely impound water. For these reasons, the ultimate embankment height for

roads as dams is 1,468 feet. The actual constructed ultimate elevation may be different, but 1,468 feet is the probable maximum elevation.

As discussed in Section F, page 9, funding limitations may require the ultimate embankment height to be constructed in phases. The embankments would be designed to meet geotechnical and structural dam safety criteria. However, it is possible that due to funding limitations, the interim embankment elevations would not be constructed to an elevation that would meet the hydraulic component of the dam safety criteria. Project-specific hydraulic criteria would be developed for the interim construction phases using a risk-based approach. An inability to satisfy the hydraulic criteria could result in an increased risk of the lake overtopping the embankments already constructed. If interim phases do not meet the hydraulic component of the dam safety criteria, homes would continue to not be eligible for a reduction in flood insurance. Landowners behind dams would be encouraged to work with FEMA to determine the appropriate flood insurance needed given that the risk of overtopping would not be immediately addressed. If dams are constructed to the ultimate elevation, FEMA would determine whether the protection is adequate to qualify homes and businesses behind the dams to be eligible for flood insurance rate reductions.

One advantage of constructing roads as dams is that this action maximizes the use of existing right-of-way (ROW) and the location is predetermined by the existing roadway footprint. Reconstructing the roads to be safe dams can also provide the added benefit of protecting lands and properties on the landward side of the dams.

There are disadvantages associated with this type of alternative as well. Because ND 20 and ND 57 are state roads, they need to be built to state and federal standards and guidelines, which result in wider dimensions that would require additional ROW and borrow to be obtained. Also, the interior drainage on the landward side of the roads would need to be addressed if there are areas that pond water against the embankments. Additionally, building roads as dams to hold back water is typically more expensive than building them just as roads with culverts that allow for water on both sides of the road. This is because the materials such as the clay needed for the core and the sand needed for the seepage drain are more expensive and the construction methods are more tightly controlled. Also, this type of action would likely require reconstructing the RAADs in standing water, thereby requiring the added expense of using cofferdams. Another disadvantage of this alternative is that any further work on the roads would require the incorporation of the safety requirements described above and would require receiving approval from a dam-building agency in order for federal funds to be used. This adds another layer of review resulting in additional cost and time. Finally, RAADs would require additional maintenance responsibilities in terms of periodic inspections, which would result in additional costs. This option is not feasible for every road, such as BIA Road 1, depending upon soil types and other factors. This is discussed further under the "Alternatives Considered but Dismissed from Further Analysis" section at the end of this chapter.

b) Construct New or Raise Existing Perimeter Dams

This action involves the construction of new perimeter dams in locations away from the roads, or raising, extending, and improving existing perimeter dams. The dams would be situated in such a way as to minimize construction and maximize the protection of the transportation network. Perimeter dams would incorporate those safety requirements and embankment heights as described in the immediately preceding section "Raise and Construct a Project Road as a Dam."

One advantage of this action is that perimeter dams could involve less impact compared to other options. Perimeter dams are narrower in width because perimeter dams need only accommodate maintenance traffic and not two-way public traffic. As a result, perimeter dams would result in narrower ROW requirements compared to constructing roads-as-dams, though additional ROW would still need to be acquired. This advantage results in less cost compared to building roads as dams. Another advantage associated with this action is that perimeter dams would typically protect larger areas of land than building the roads as dams. Finally, the construction of perimeter dams may permit some RAADs to be equalized, thereby removing the approval requirements by a dam-building agency and the safety concerns and monitoring costs associated with RAADs.

Disadvantages associated with constructing perimeter dams include the need to purchase additional ROW and obtain borrow. However, the costs for both ROW and borrow by the mile could be less than constructing roads as dams given the narrower cross-section width. Also, the interior drainage on the landward side of the roads may need to be addressed if there are areas where water ponds against the embankments. Another disadvantage of this alternative is that construction of perimeter dams would involve the incorporation of the safety requirements described above and would require receiving approval from a dam-building agency. Also, some of the proposed perimeter dams are in locations that may involve the construction of temporary access roads, creating additional environmental impacts. Additionally, some of the proposed perimeter dams are in locations that would require construction in standing water, thereby incurring the added expense of using cofferdams. Finally, perimeter dams would require additional maintenance responsibilities and costs in the form of periodic inspections.

c) Raise and Equalize Project RAAD

Under this action, a project RAAD would be raised, and culverts would be installed through the roadbed to allow for the equalization of the water level. Since water would no longer be pushing against the roadway structure from one side, this option alleviates the safety issues of the existing RAADs because the water level would be the same on both sides of the road (**Figure 2-2**). However, the equalized roads would require the same embankment heights of approximately 1,468 feet for reasons described in the section "Raise and Construct a Project Road as a Dam."

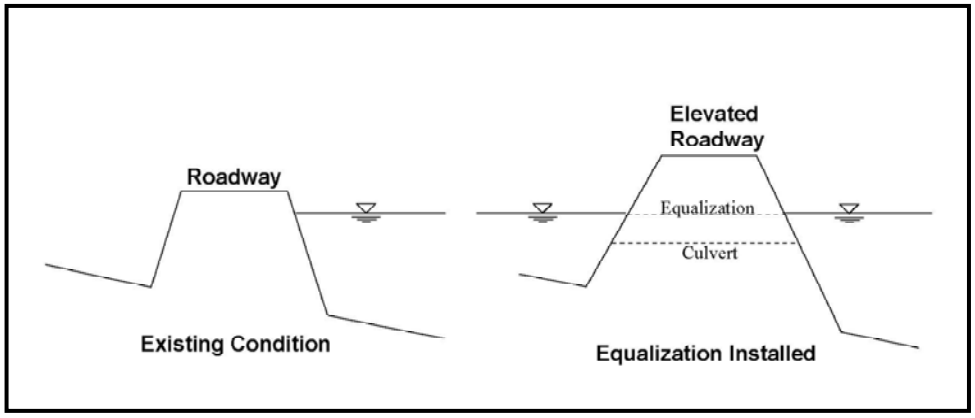

Figure 2-2. Equalization

Advantages associated with equalization would include a small cost savings in construction compared to constructing roads as dams. There would also be no costs associated with constructing, maintaining, and monitoring an internal drainage control system. Since they would no longer be acting as dams, the roads would not require dam-specific monitoring or maintenance.

Disadvantages associated with equalization include the flooding of the landward side of the RAADs, as the Lake continues to rise. This would result in the loss of lands, some residences and businesses, and components of the transportation network unless those components are also raised. Also, like constructing the roads-as-dams, additional ROW would need to be acquired.

d) Abandonment of Select Roads

Abandonment would close a road to further travel and would be considered for roads that might be realigned or where maintaining access is determined no longer necessary or alternative access is provided. The road would no longer be maintained and would run the risk of failing or being overtopped should the lake level continue to rise as anticipated. Abandonment could simply involve no further work on the road or could allow, under controlled conditions, equalization of the embankments to prevent a potential catastrophic failure caused by overtopping. Abandonment could result in the loss of property due to either the loss of access or flooding. If any state highways were abandoned, this action would require compliance with Section 24-07 of the North Dakota Century Code. Abandonment would be a less costly option than construction, but could result in a loss of access.

e) Realignment of Roads

Under certain conditions, it may be prudent to realign the road rather than raise and equalize or build it as a dam along its current alignment. Conditions that could warrant the consideration of realignment include but are not limited to the availability of alternative alignments at higher elevations, property access, safety concerns associated with continuing to build roads where water borders each side

of the road, and availability of material for dam construction. Realignment would result in impacts in new areas, but could, in some circumstances, result in lower total costs or impacts.

B. Alternatives

1. No Action

Consideration of the No Action Alternative is required by NEPA. Analysis of the No Action Alternative is critical as it provides a benchmark against which the decision-makers and the public can compare the magnitude of environmental effects of the build alternatives. The No Action Alternative can be considered as the unaltered present course of action and normally includes short-term, minor restoration activities (e.g. safety and maintenance improvements, etc.) that would likely occur. Where the No Action Alternative would result in predictable actions by others, such actions should be included in the analysis.

If the proposed action is not implemented, no action would be taken to correct the current conditions of the RAADs. The roads would continue to pose a threat to the traveling public and local communities because they still contain geotechnical and hydraulic defects for purposes of safely impounding water. Responsible agencies would need to monitor the RAADs and existing dams. In the event that a weakening of the structure is detected, individuals on the landward side of the structures would have to be notified prior to possible failure of these structures, and property damage could not be averted (*Benson County et al. 2005*).

If the Lake continues to rise as expected, several possible actions or combinations of such may occur. One possible action is that, in some areas, the roads would continue to be raised under emergency procedures as the lake level approaches the road surface elevation. Because the hydraulic and geotechnical defects of the RAADs will not have been addressed, the road structures would not be considered as safe long-term impoundments of water. As a result, the threat of the structures failing would remain, and no federal funding would be available for this emergency (**Appendix A**).

Another possibility is that, if the Lake continues to rise as expected, a decision could be made to discontinue raising the roads and to use alternative routes such as US 281 and BIA Roads 6 and 16. In effect, those roads not raised would be abandoned as has been done for other roads in the region like BIA Roads 18 and 19. If the Lake elevation continues to rise, the RAADs would overtop, forcing road closures and flooding areas on the landward side. Whether the roads are overtopped or collapse under catastrophic failure, access between the City of Devils Lake and the Fort Totten/St. Michael area via ND 20 and ND 57 would no longer be available and residents and travelers would have to use US 281. Intraregional access within the St. Michael area would be reduced due to overtopping of the RAADs and the flooding of other parts of the transportation network that are currently protected by these RAADs.

The most likely outcome of the No Action Alternative is that some combination of the above outcomes would occur. There would be no comprehensive planning, and

individual agencies would likely make decisions regarding roads on a case-by-case basis resulting in inconsistent treatment of these roads.

2. Build Alternatives

The build alternatives are presented by zone. The alternatives comprise the different types of actions discussed earlier in this chapter. Each build alternative described below addresses each RAAD within that zone and is accompanied by its own figure. In some cases, there will appear to be little difference among the build alternatives. This is because the difference between some alternatives consists of the treatment of just one of the RAADs in the zone. As discussed at the beginning of this chapter, the components of each alternative must be cohesive and consistent with each other within the zone so it is not feasible to look at dams or roadway segments independently of the others within a specific zone. They must be viewed in relation to one another to understand the full effect in how the alternative meets the purpose and need described in Chapter 1. Included in the discussion of each build alternative is a preliminary cost estimate to construct each alternative to an ultimate elevation of 1,468 feet to accommodate the ultimate still water lake elevation of 1,460 feet in year 2007 dollars.

To demonstrate the full effect of the manner in which the proposed build alternatives protect the transportation network, estimated water levels at 1,460 feet are shown on the figures depicting the build alternatives. Also, for comparative purposes, a map showing the No Action Alternative at a lake elevation of 1,460 feet is included **(Figure 2-3)**.

a) Zone 1

RAADs in Zone 1 consist of BIA Roads 1, 4, and 5 and a portion of ND 57. All of these roads had their culverts blocked and are currently acting as dams, holding back Devils Lake from inundating the transportation network to the southeast, including BIA Roads 1, 9, and 16. Only one build alternative, Alternative 1-A, is being considered for this zone and it is the Preferred Alternative. Alternative 1-A consists of the following components:

(1) Alternative 1-A – Preferred Alternative in Zone 1 **(Figure 2-4)**

- Raise and equalize the portion of BIA Road 1 between ND 57 and BIA Road 4
- Raise and equalize the portion of ND 57 between BIA Road 15, locally known as Ski Jump Road, and BIA Road 1
- Raise and construct as a dam about one mile of BIA Road 5 from its intersection with BIA Road 4 north to high ground. Raise and construct as a dam BIA Road 4 from its intersection with BIA Road 5 to a little less than one mile south of its intersection with BIA Road 1

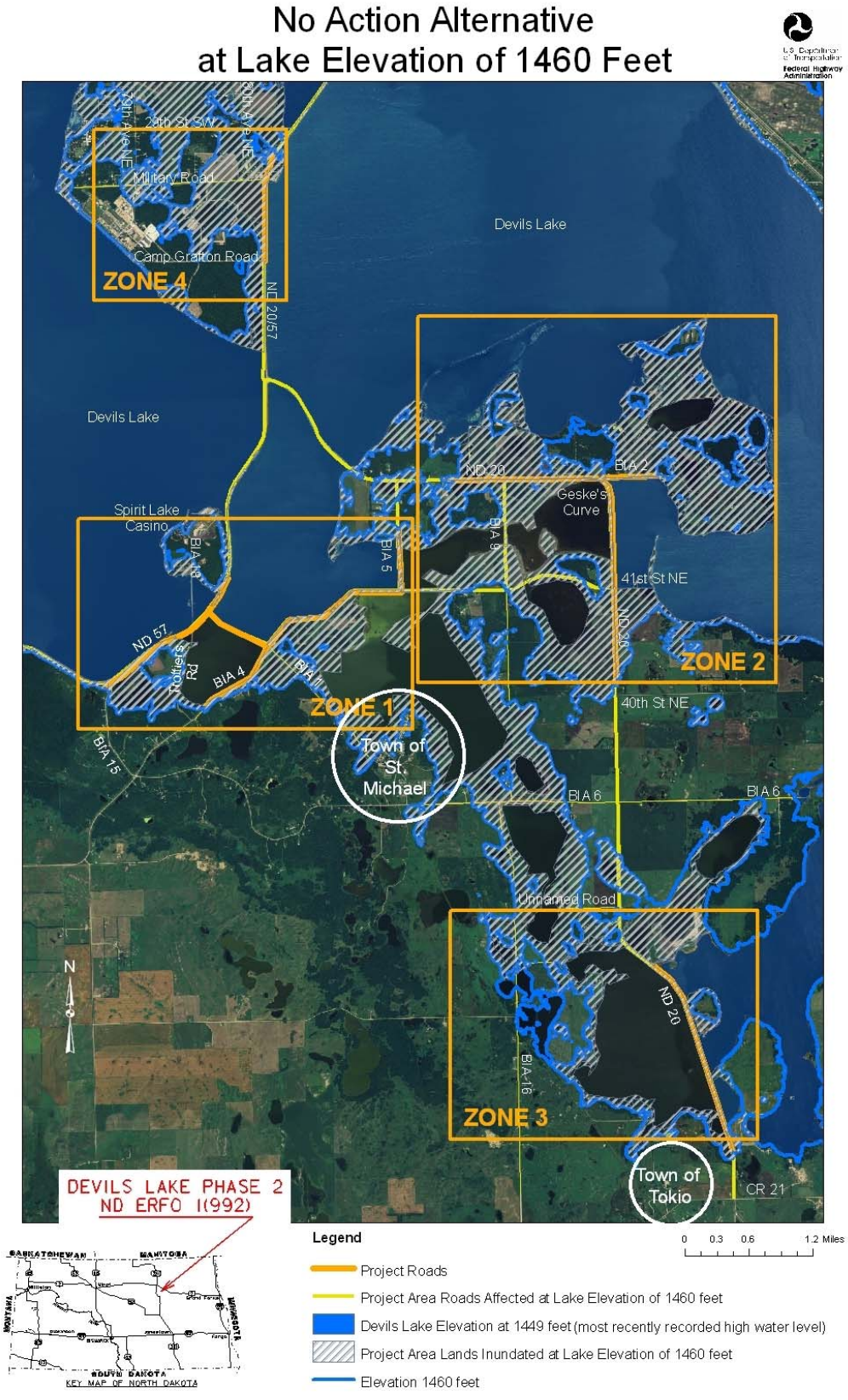

Figure 2-3. No Action Alternative at Lake Elevation of 1,460 Feet

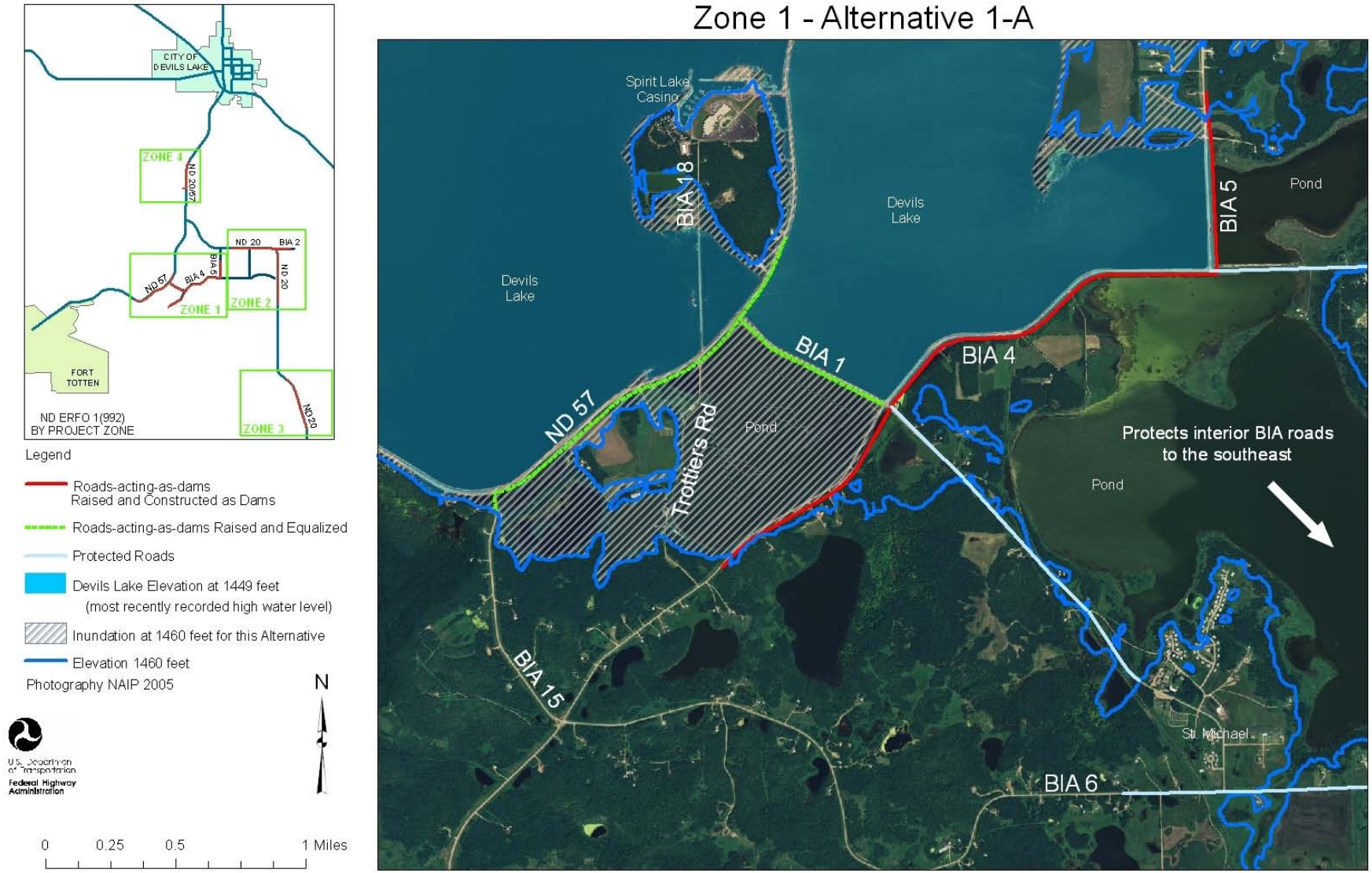

Figure 2-4. Zone 1 – Alternative 1-A

While BIA Road 1 and ND 57 would be equalized, thereby permitting inundation of water to the southeast, BIA Road 4 would be built as a dam preventing the waters from inundating the transportation network further to the southeast. This alternative also has the added benefit of protecting lands and residences to the southeast of BIA Road 4. By equalizing ND 57 and BIA Road 1, these roads would no longer require monitoring and approval from a dam-building agency for future work. Disadvantages associated with this alternative include the need to continue to monitor BIA Roads 4 and 5 and the need to receive approval from dam-building agencies when additional work is performed on these roads. The preliminary cost estimate to build this alternative to the ultimate road elevation of 1,468 feet is approximately $126 million.

Other build alternatives were considered for this area including constructing BIA Road 1 as dam, constructing parallel dams, and equalizing BIA Roads 4 and 5. For reasons explained in Section D, "Alternatives Considered but Dismissed from Further Analysis," these alternatives were eliminated from further consideration.

b) Zone 2

Currently, a number of perimeter dams north of ND 20 and BIA Road 2 are at an elevation of 1,453 feet. Also, ND 20 from BIA Road 2 south to its intersection with BIA Road 4 and the western portion of BIA Road 2 had their culverts blocked and are acting as dams. These dams and portions of roads are holding back Devils Lake from inundating the regional transportation network to the southwest. Five alternatives have been identified for this zone. Alternatives 2-A through 2-C differ in the treatment of the area near the intersection of ND 20 and BIA Road 2. For alternatives 2-A through 2-C, and 2-E, the elevation to which BIA Road 2 would be ultimately raised is uncertain because its continued functionality depends on the elevation to which the lake waters rise. Currently, BIA Road 2 provides access to approximately nine residences. However, as the lake waters rise and land is inundated from the north and east, the need for the road to be maintained or raised may be eliminated given that seven of the nine residences it currently accesses would likely need to relocate to avoid inundation. It may be the case that this road would be raised to an interim elevation to provide service until the lands are inundated to the extent that it is no longer cost effective to maintain the access.

(1) Alternative 2-A (Figure 2-5)

- Raise and construct ND 20 as a dam from BIA Road 2 south to the new Kuk Dam
- Raise and extend existing perimeter dams Jetty 1 and Jetty 2 north of ND 20
- Construct the Kuk Dam, a new perimeter dam, extending east to high ground from ND 20 just south of its intersection with BIA Road 4

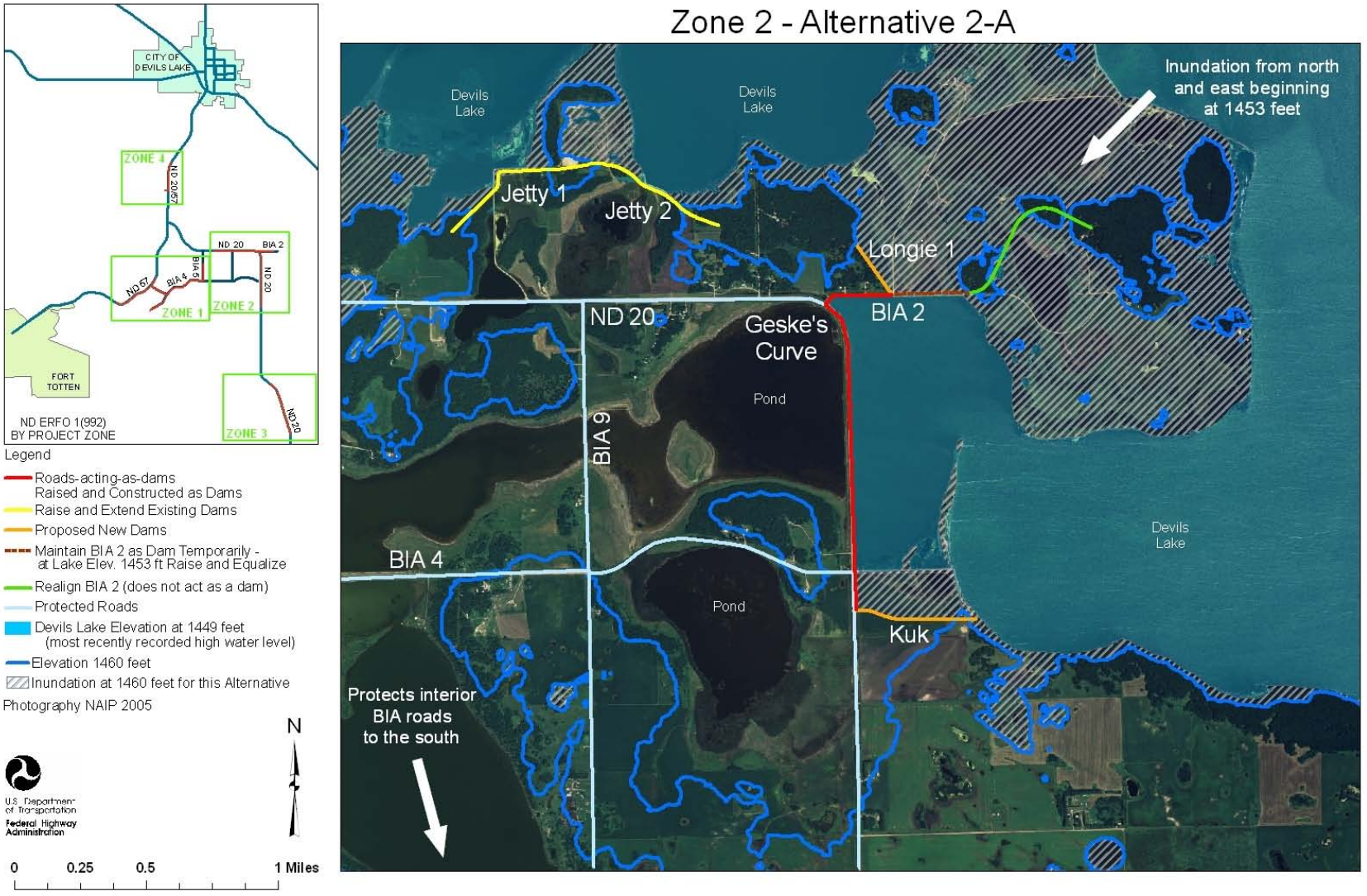

Figure 2-5. Zone 2 – Alternative 2-A

- Raise and construct the western portion of BIA Road 2 as a dam
- Construct the Longie 1 Dam, a new perimeter dam, off of BIA Road 2
- Allow BIA Road 2 east of Longie 1 Dam to remain a dam until a lake elevation of 1,453 feet is reached at which point BIA Road 2 would be equalized and the eastern portion may be raised and realigned.

This alternative takes advantage of the existing perimeter dams to the north of ND 20 and involves the construction of two new perimeter dams, Longie 1 and Kuk. These new perimeter dams would prevent inundation of the transportation network to the southwest and also provide the added benefit of protecting lands and residences north of the western portion of BIA Road 2 and ND 20. However, the residences to the north of BIA Road 2 would likely have to be relocated because the increased width of BIA Road 2 would impact one house and make access to the other homes too steep. Disadvantages associated with this alternative include the need to continue to monitor a little over one mile of ND 20 and BIA Road 2 that would be dams and the need to receive approval from dam-building agencies when additional work is performed on those portions of the roads. The SLN does not support this alternative because fewer trust assets are afforded protection than alternative 2D. The preliminary cost estimate to build this alternative to the ultimate elevation of 1,468 feet is approximately $72 million.

(2) Alternative 2-B **(Figure 2-6)**

- Raise and construct ND 20 as a dam from BIA Road 2 to just south of BIA Road 4
- Raise and extend existing perimeter dams Jetty 1 and Jetty 2, north of ND 20
- Construct the Kuk Dam, a new perimeter dam, extending east to high ground from ND 20 just south of its intersection with BIA Road 4
- Construct the Longie 2 Dam, a new perimeter dam, off of BIA Road 2
- Allow BIA Road 2 east of Longie 2 Dam to remain as a dam until a lake elevation of 1,453 feet is reached at which point water comes in from the North, at which point BIA Road 2 would be equalized, and the eastern portion may be raised and realigned.

Similar to Alternative 2-A, this alternative takes advantage of the existing dams to the north of ND 20 and it involves the construction of two new perimeter dams, Longie 2 and Kuk. These new dams would prevent inundation of the transportation network to the southwest and would also provide the added benefit of protecting lands, though not as much land as Longie 1. By equalizing BIA Road 2, this road would no longer require monitoring and approval from a dam-building agency for future work. Disadvantages associated with this alternative include the need to continue to monitor a little over one mile of ND 20 acting as dams and the need to receive approval from dam-building agencies when additional work is

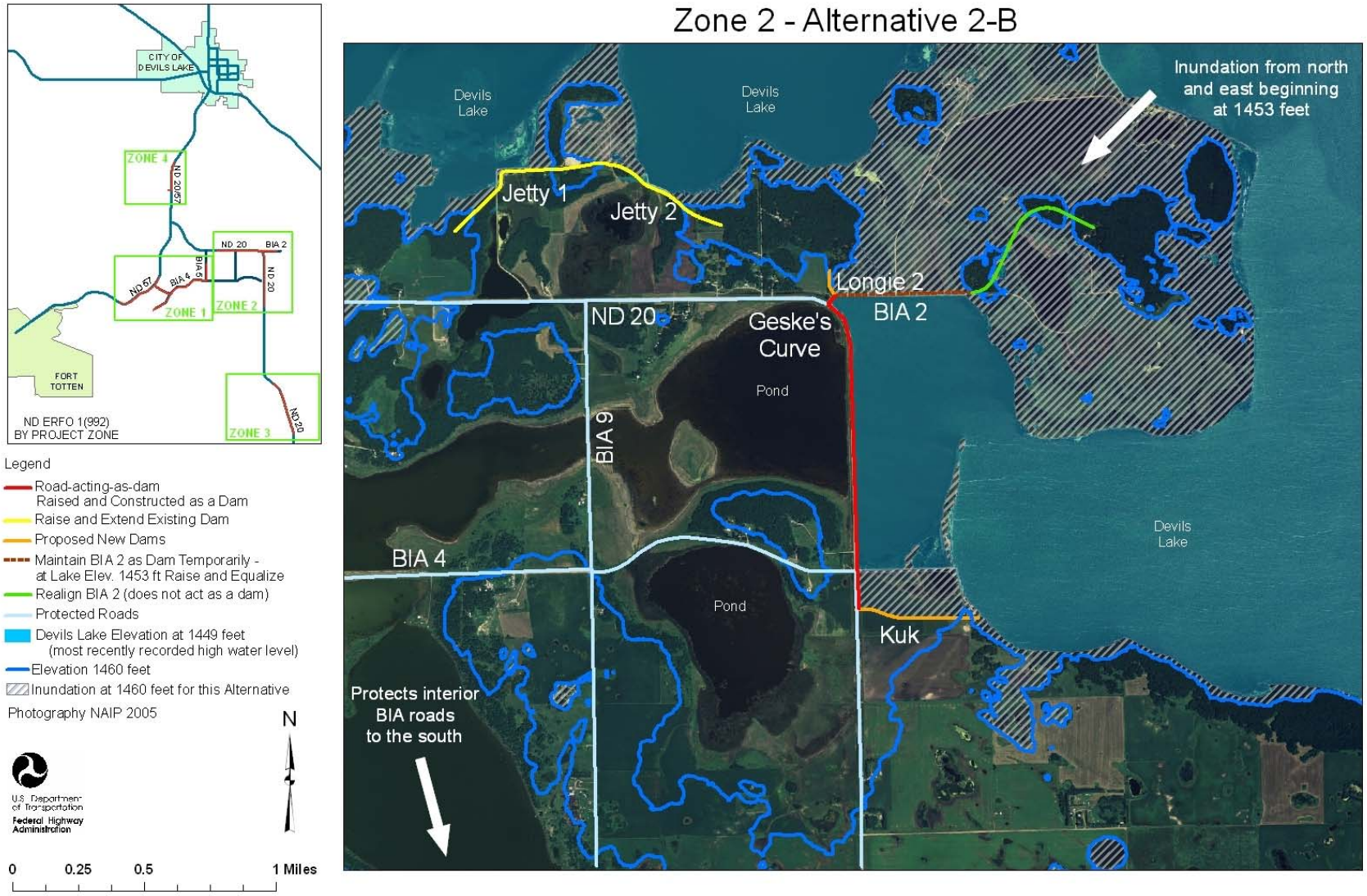

Figure 2-6. Zone 2 – Alternative 2-B

performed on these portions of the road. The SLN does not support this alternative because fewer trust assets are afforded protection than alternative 2D. The preliminary cost estimate to build this alternative to the ultimate elevation of 1,468 feet is $67 million.

(3) Alternative 2-C (Figure 2-7)

- Raise and construct ND 20 as a dam from one-half mile west of BIA Road 9 to just south of the intersection with BIA Road 4
- Construct the Kuk Dam, a new perimeter dam, extending east to high ground from ND 20 just south of its intersection with BIA Road 4
- Allow BIA Road 2 east of its intersection of ND 20 to remain as a dam until a lake elevation of 1,453 feet at which point it would be equalized, and the eastern portion may be raised and realigned.

Unlike alternatives 2-A and 2-B, this alternative raises and constructs the east-west section of ND 20 as a dam rather than the perimeter dams to the north of ND 20. By raising and constructing this portion of ND 20 as a dam, the transportation network to the southwest is protected from inundation. Disadvantages associated with this alternative include the need to continue monitoring the almost three miles of ND 20 that would be built as a dam and receiving approval from a dam-building agency for future work on this portion of ND 20. The preliminary cost estimate to build this alternative to the ultimate elevation of 1,468 feet is approximately $88 million.

(4) Alternative 2-D – Preferred Alternative in Zone 2 (Figure 2-8)

- Raise and extend existing dams Jetty 1 and Jetty 2, north of ND 20
- Construct a new perimeter dam, approximately 2.2 miles in length, using existing perimeter dams, Geske 1 and 4, and extending across a small bay area to the south of BIA Road 2
- Pump small bay area south of BIA Road 2 and east of ND 20 into Devils Lake and equalize ND 20 and BIA Road 2

This alternative involves work on existing and new perimeter dams and maximizes the use of the existing perimeter dams to protect the transportation system to the southwest. This perimeter dam may allow portions of BIA Road 2 and ND 20, currently acting as dams, to be equalized, if it is feasible to pump the small bay area between ND 20 and the new perimeter dam down to a level that would not cause inundation to lands on the northern side of BIA Road 2 on the western side of ND 20 should the roads be equalized. If this occurs, these portions of roads would no longer be acting as dams, thereby removing the need for any monitoring and approval from a dam-building agency for future work. This alternative also provides the added benefit of protecting property, all of BIA Road 2, the residences north of BIA 2, and a township road extending north off of BIA Road 2. Also, even though the combined

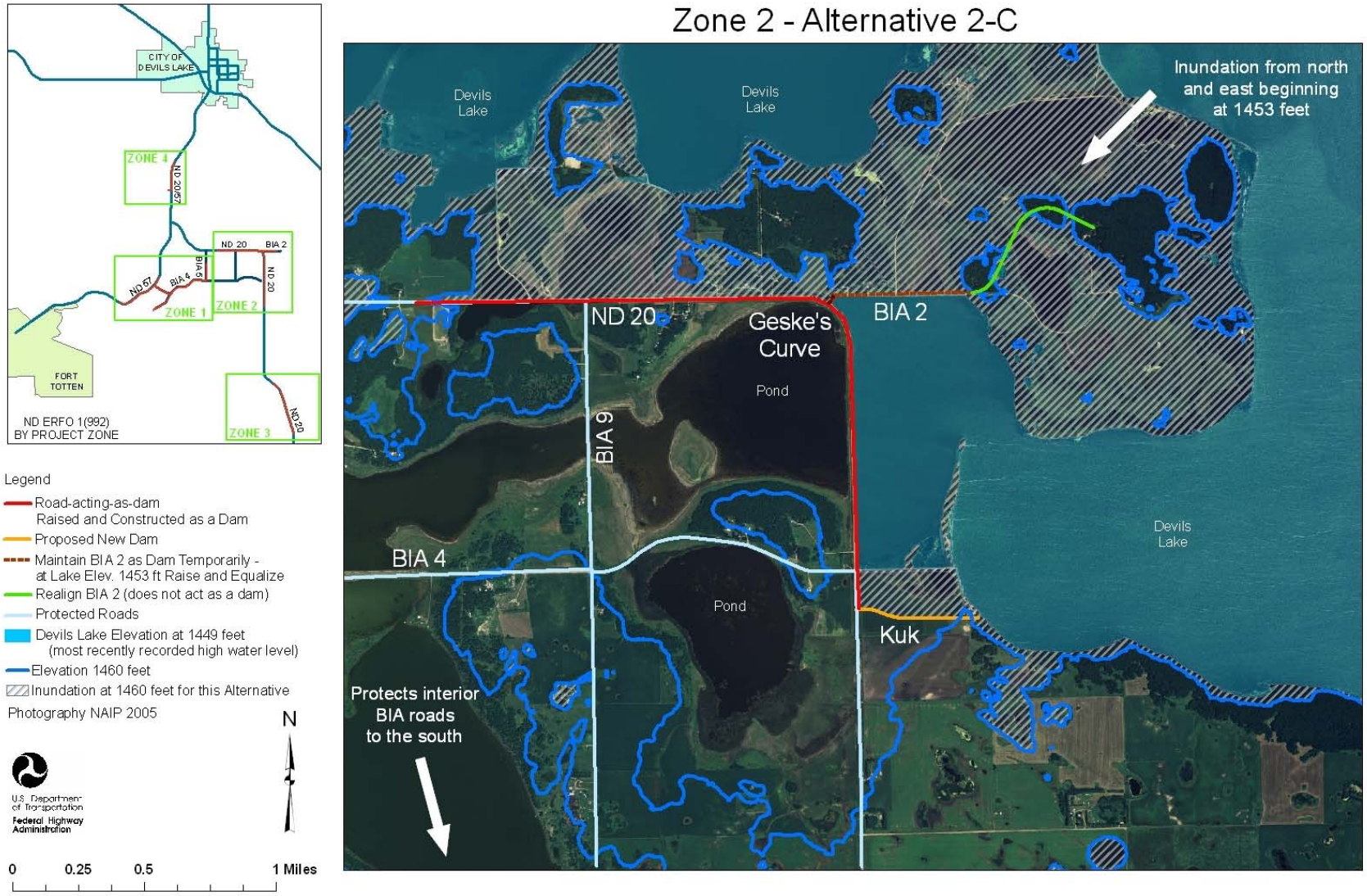

Figure 2-7. Zone 2 – Alternative 2-C

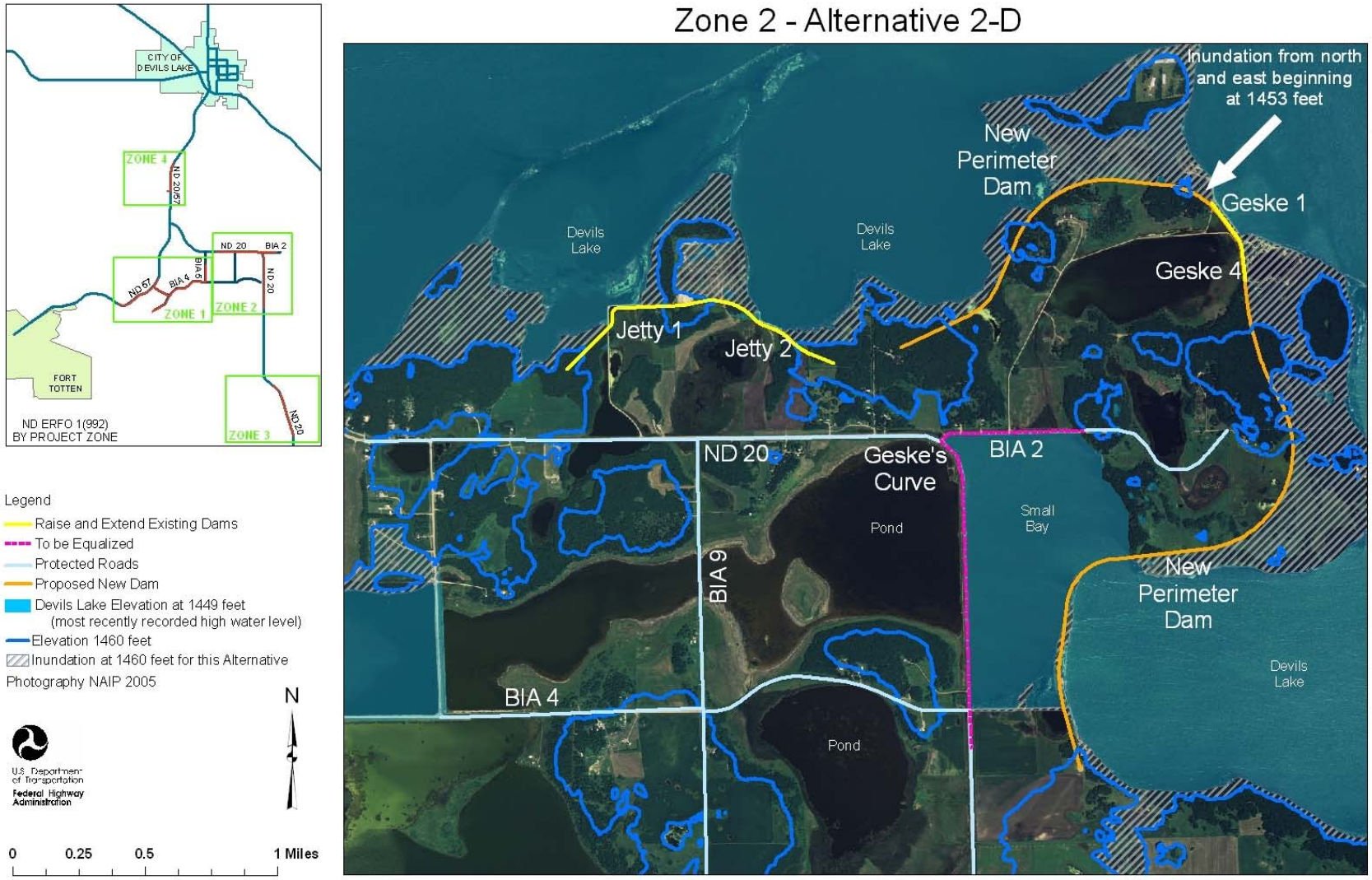

Figure 2-8. Zone 2 – Alternative 2-D

length of the structures in this alternative is longer than those proposed in Alternatives 2-A through 2-C, this alternative is less expensive because the perimeter dam is narrower than the roads proposed in the other alternatives. As a result, less material and construction work is required. Finally, this alternative is supported by SLN because of the added protection of trust assets. The main disadvantage associated with this alternative is that, because it is longer, there is concern about raising the entire length of this dam quickly should the lake level rise rapidly. The preliminary cost estimate to build this alternative to the ultimate elevation of 1,468 feet is approximately $63 million.

(5) Alternative 2-E **(Figure 2-9)**

- Raise and extend existing perimeter dams Jetty 1 and Jetty 2, north of ND 20
- Construct a new perimeter dam, approximately one mile in length, that extends across a small bay area to the south of BIA Road 2 and roughly parallels the north-south portion of ND 20 that is acting as a dam and BIA Road 2
- If feasible, pump small bay area south of BIA Road 2 and east of ND 20 into Devils Lake and equalize ND 20 and BIA Road 2
- Possibly raise and realign the eastern portion of BIA Road 2

This alternative involves work primarily on existing and new dams to protect the transportation system to the southwest. This perimeter dam may allow portions of BIA Road 2 and ND 20, currently acting as dams, to be equalized, if it is feasible to pump the small bay area down to a level that would not cause inundation to lands on the northern side of BIA Road 2, should the roads be equalized. If this occurs, these portions of the roads would no longer be acting as dams, thereby removing the need for any monitoring and approval from a dam-building agency for future work. This alternative provides the added benefit of protecting homes north of BIA Road 2. The new perimeter dam is approximately one mile shorter in length than Alternative 2-D and is of comparable length to the impoundments proposed in Alternatives 2-A through 2-C. The disadvantages of this option are that BIA 2 may not be protected at the ultimate elevation and may eventually be abandoned. The SLN does not support this alternative because fewer trust assets are afforded protection than alternative 2D. The preliminary cost estimate to build this alternative to the ultimate elevation of 1,468 feet is approximately $44 million.

c) Zone 3

In this zone, where ND 20 crosses Spring Lake, the culverts of ND 20 were blocked to allow this section of ND 20 to hold back the waters of Devils Lake. However, due to high upland runoff inflows from the southwest, Spring Lake sometimes becomes higher than Devils Lake.

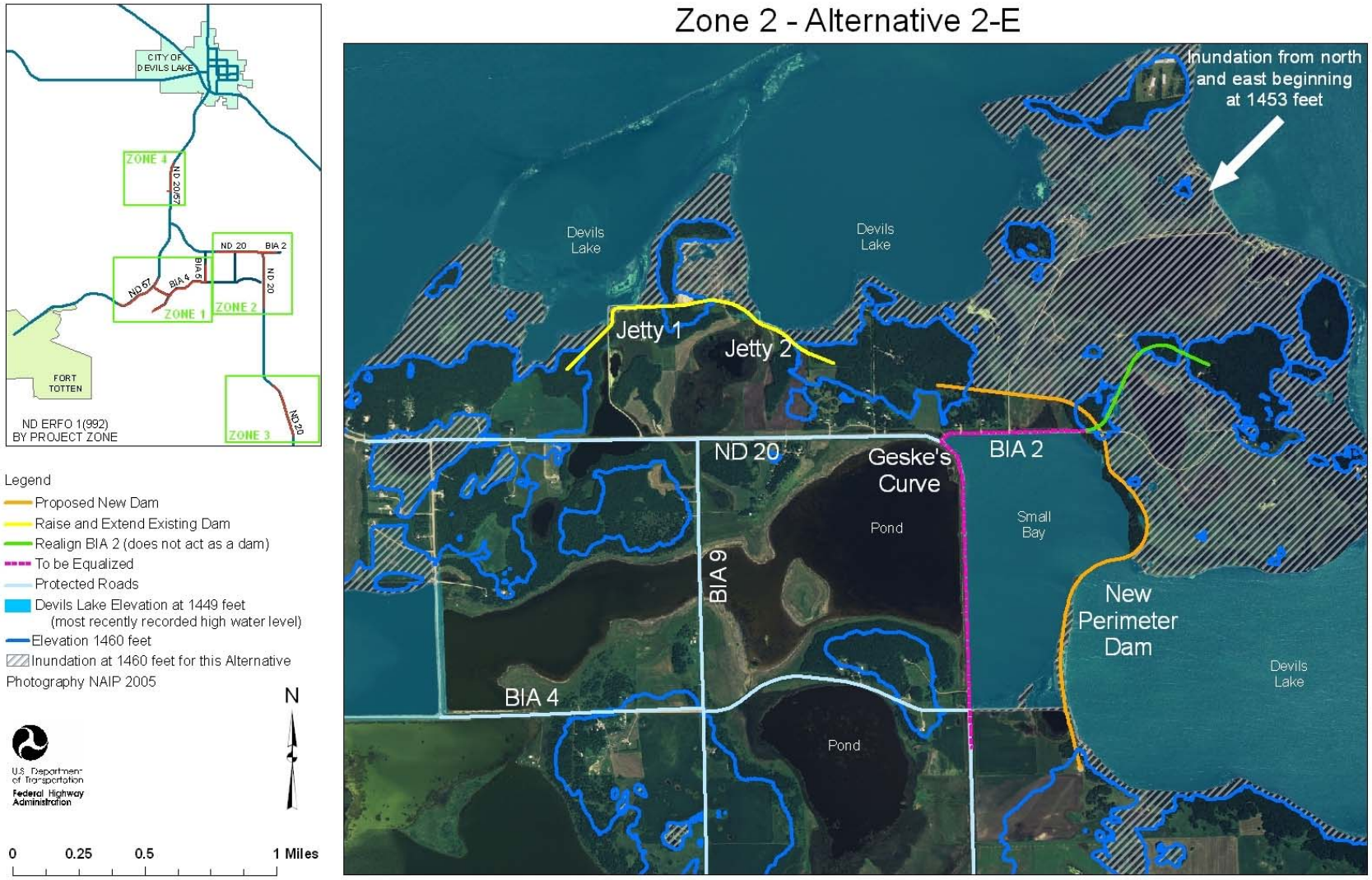

Figure 2-9. Zone 2 – Alternative 2-E

(1) Alternative 3-A –Preferred Alternative in Zone 3 **(Figure 2-10)**

- Equalize ND 20 from unnamed township road one mile south of BIA Road 6 to near BIA Road 22
- Construct the Spring Lake Dam, a new perimeter dam, northwest of Spring Lake
- Construct Kurtz 2 Dam, a new perimeter dam, one-quarter mile northeast of the unnamed township road

This alternative would permit Spring Lake to equalize with Devils Lake. In order to protect the transportation network to the north and northwest from inundation, the Spring Lake Dam would be constructed. Also, the Kurtz 2 Dam would be constructed to the east of ND 20 to prevent Devils Lake from inundating a small portion of ND 20. Some minor work on BIA Road 6 may also be required. This alternative would permit all of ND 20, currently acting as a dam, to be equalized, thereby eliminating the need for any monitoring and approval from a dam-building agency for future work. Construction of the Kurtz 2 Dam is at higher ground, allowing for a shorter perimeter dam compared to what is proposed in Alternative 3-B below. The preliminary cost estimate to build this alternative to the ultimate elevation of 1,468 feet is approximately $58 million.

(2) Alternative 3-B **(Figure 2-11)**

- Build ND 20 as a dam from the unnamed road one mile south of BIA Road 6 to near the access road to the Kurtz 1 Dam
- Equalize ND 20 south from the Kurtz 1 Dam access road to near BIA Road 22
- Construct the Spring Lake Dam, a new perimeter dam, northwest of Spring Lake
- Extend Kurtz 1 Dam to connect to ND 20 to the west and high ground to the east

Similar to Alternative 3-A, this alternative would permit Spring Lake to equalize with Devils Lake. In order to protect the transportation network to the north and northwest from inundation of Devils Lake as it rises, the Spring Lake Dam would be constructed. This alternative takes advantage of the existing Kurtz 1 Dam by extending the dam so that it ties into high ground at 1,468 feet, protecting ND 20. In order to prevent water from inundating ND 20 north of Spring Lake, a small portion of ND 20 would need to be constructed as a dam. This alternative provides the added benefit of protecting some farmland and a residence as compared to Alternative 3-A. However, construction of the Kurtz 1 Dam is on lower ground and requires a longer dam than what is proposed in Alternative 3-A. The preliminary cost estimate to build this alternative is $69 million.

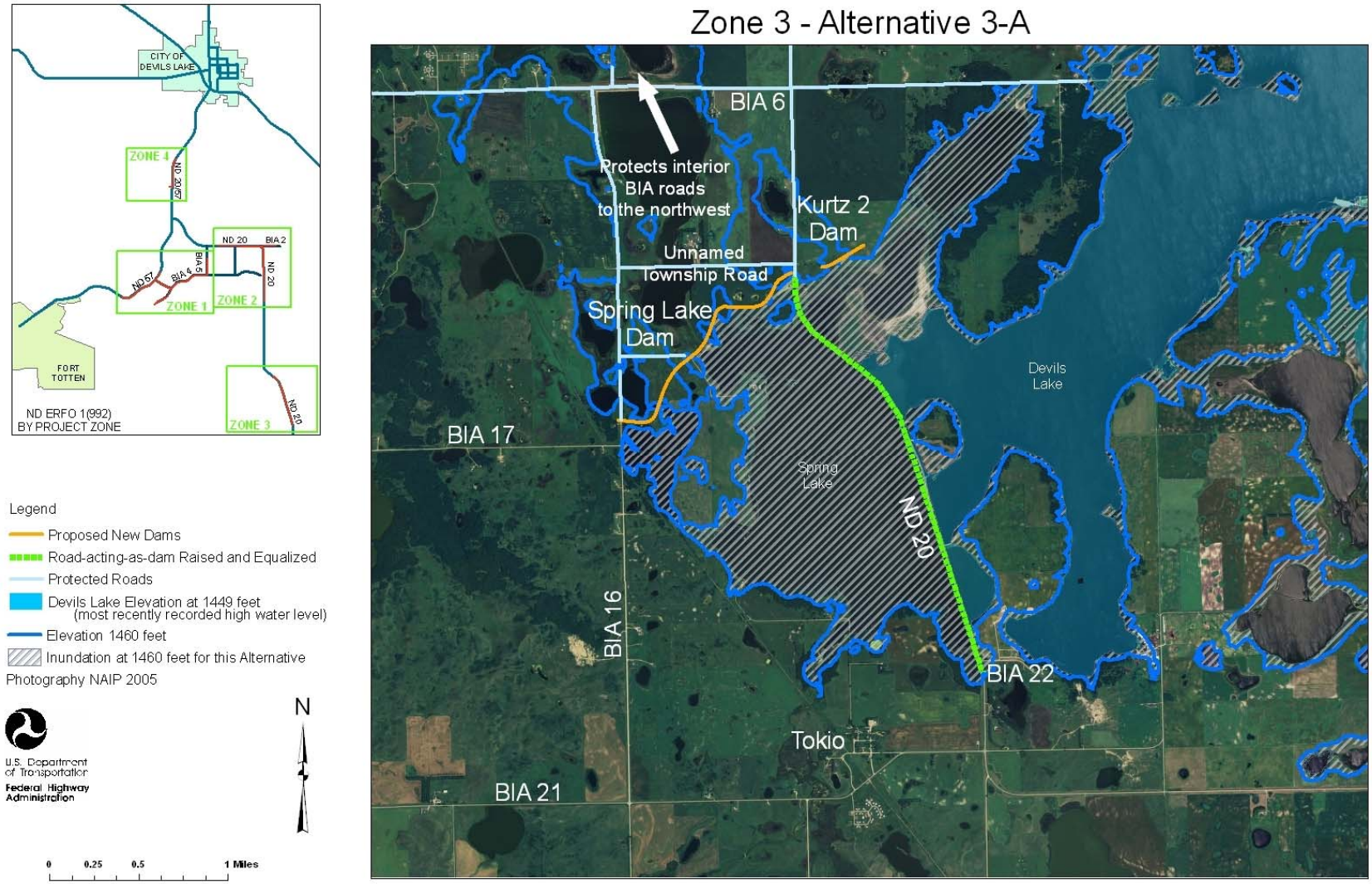

Figure 2-10. Zone 3 – Alternative 3-A

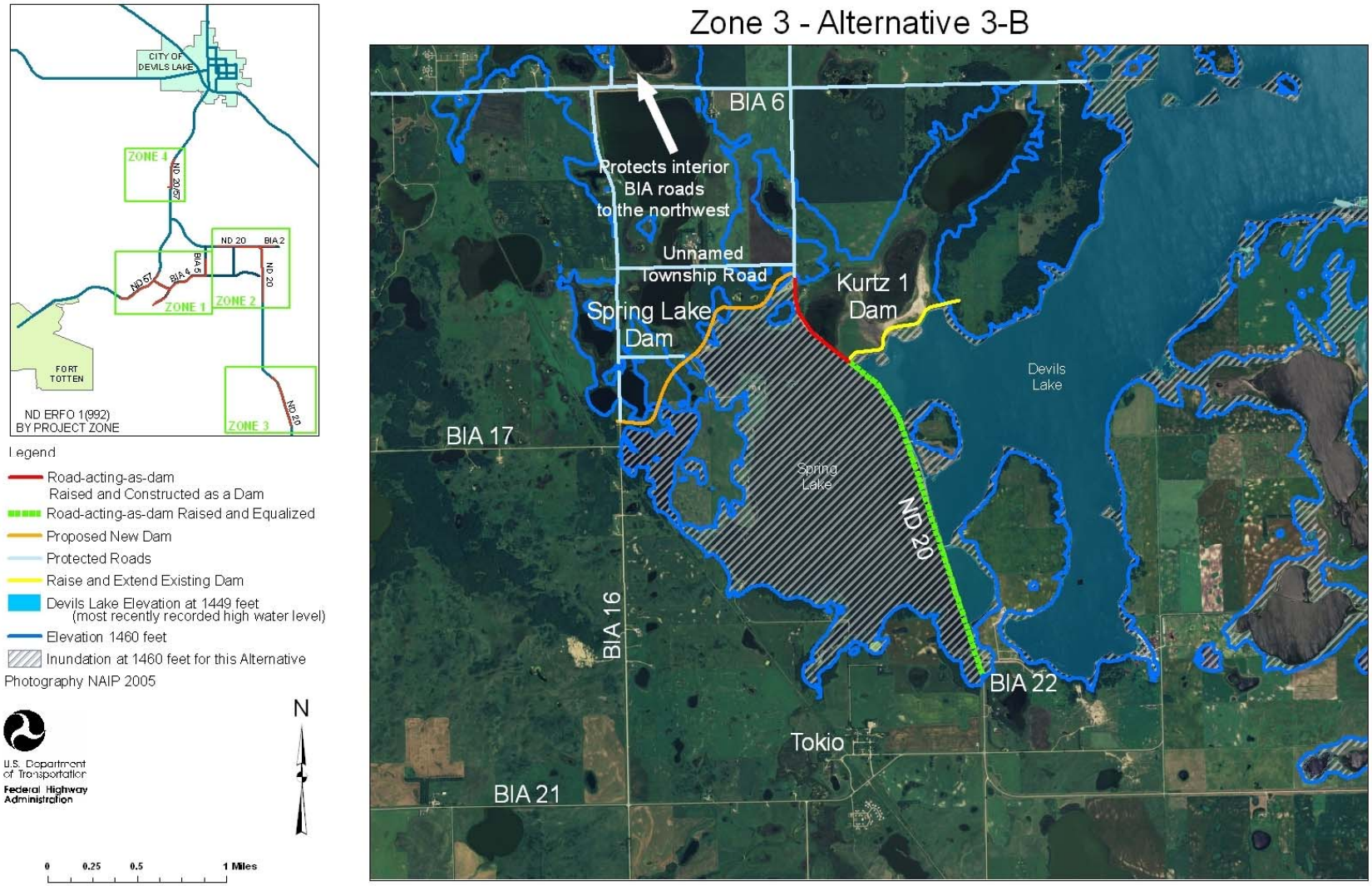

Figure 2-11. Zone 3 – Alternative 3-B

d) Zone 4

ND 20 from Military Road to the Camp Grafton entrance had its culverts blocked and is currently acting as a dam holding back Devils Lake from the east. Because the city of Devils Lake levee system is not complete on the western side of Acorn Ridge, waters could inundate from the west. This concern is not immediate and would not occur until Devils Lake reaches an elevation of 1,458 feet.

(1) Alternative 4-A **(Figure 2-12)**

- Raise and equalize a portion of ND 20 from approximately one-half mile north of Military Road to approximately one-half mile south of the Camp Grafton Entrance Road.
- Because Military Road is lower than the current Lake elevation, the eastern portion would be raised to continue to provide access to Camp Grafton and the communities on the western side of Acorn Ridge. Military Road is currently not acting as a dam nor would it be constructed to be a dam.
- Raise the eastern portion of Camp Grafton Entrance Road. This road is currently not acting as a dam nor would it be constructed to be a dam.

The elevation to which Military Road would be ultimately raised is uncertain because its continued functionality depends on whether the city of Devils Lake levee system on the western side of Acorn Ridge is completed. If the levee system is not completed, then many of the communities and the local access for communities along this road would be inundated from the west, thereby nullifying the need for Military Road. For now, it will be assumed that this road would be raised to an interim level under this alternative in order to continue to provide access to Camp Grafton and the communities to the west. By equalizing ND 20, this portion of road would no longer require monitoring or approval from a dam-building agency for future work. The preliminary cost estimate to build this alternative to the ultimate elevation of 1,468 feet is $44 million.

(2) Alternative 4-B –Preferred Alternative in Zone 4 **(Figure 2-13)**

- Raise and construct as a dam ND 20 from approximately one-half mile north of Military Road to south of the Camp Grafton Entrance.
- Raise and construct as a dam the eastern one-half mile of the Camp Grafton Entrance Road.

This alternative only partially meets the purpose and need because it affords protection of Military Road only to the elevation of 1,458 feet. Should Devils Lake rise above this elevation, waters would inundate from the north, coming in from the western side of Acorn Ridge, and overtop Military Road. Three dams would need to be constructed to prevent the inundation of Military Road. These three dams, identified on **Figure 2-13**,

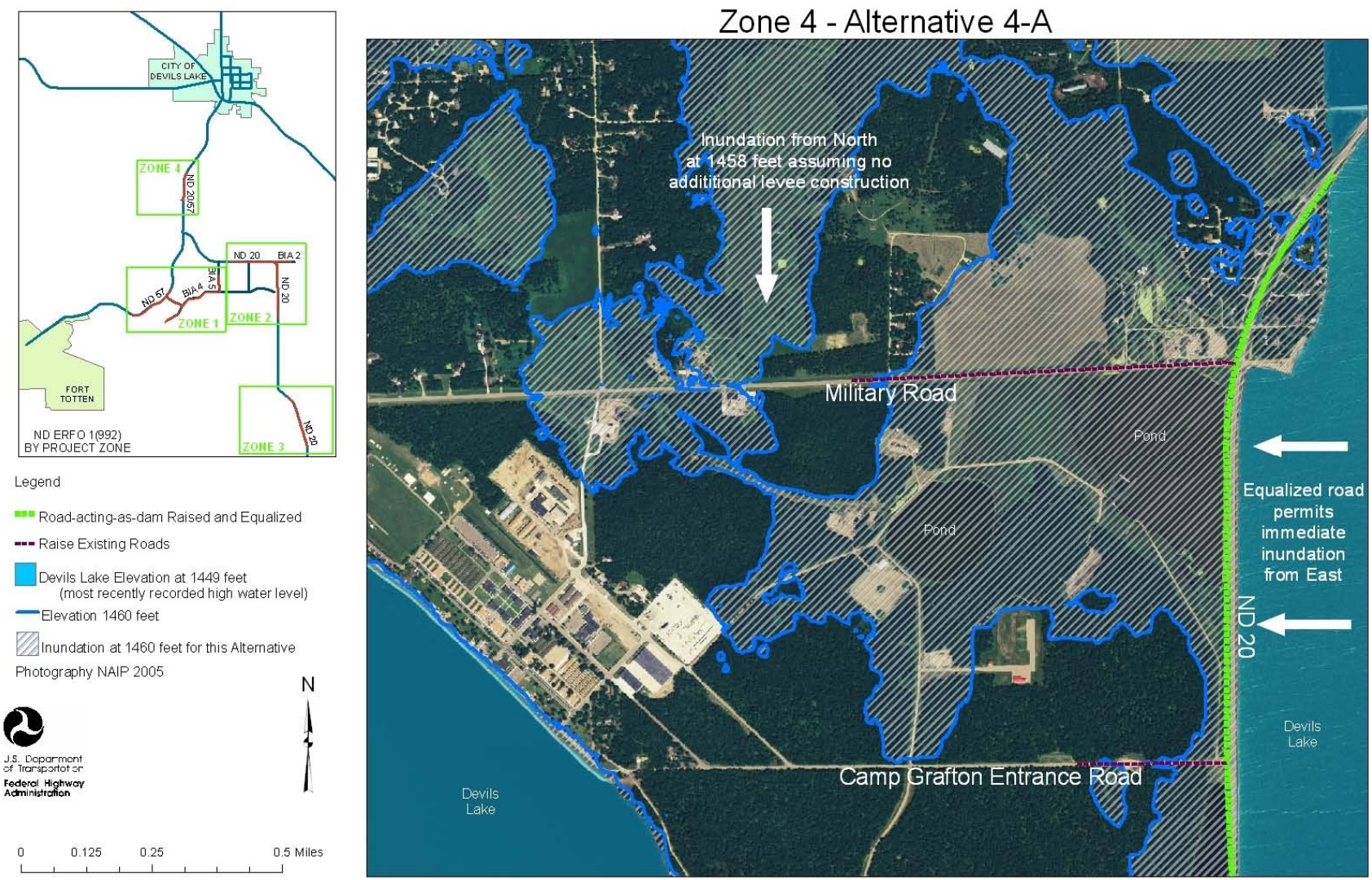

Figure 2-12. Zone 4 – Alternative 4-A

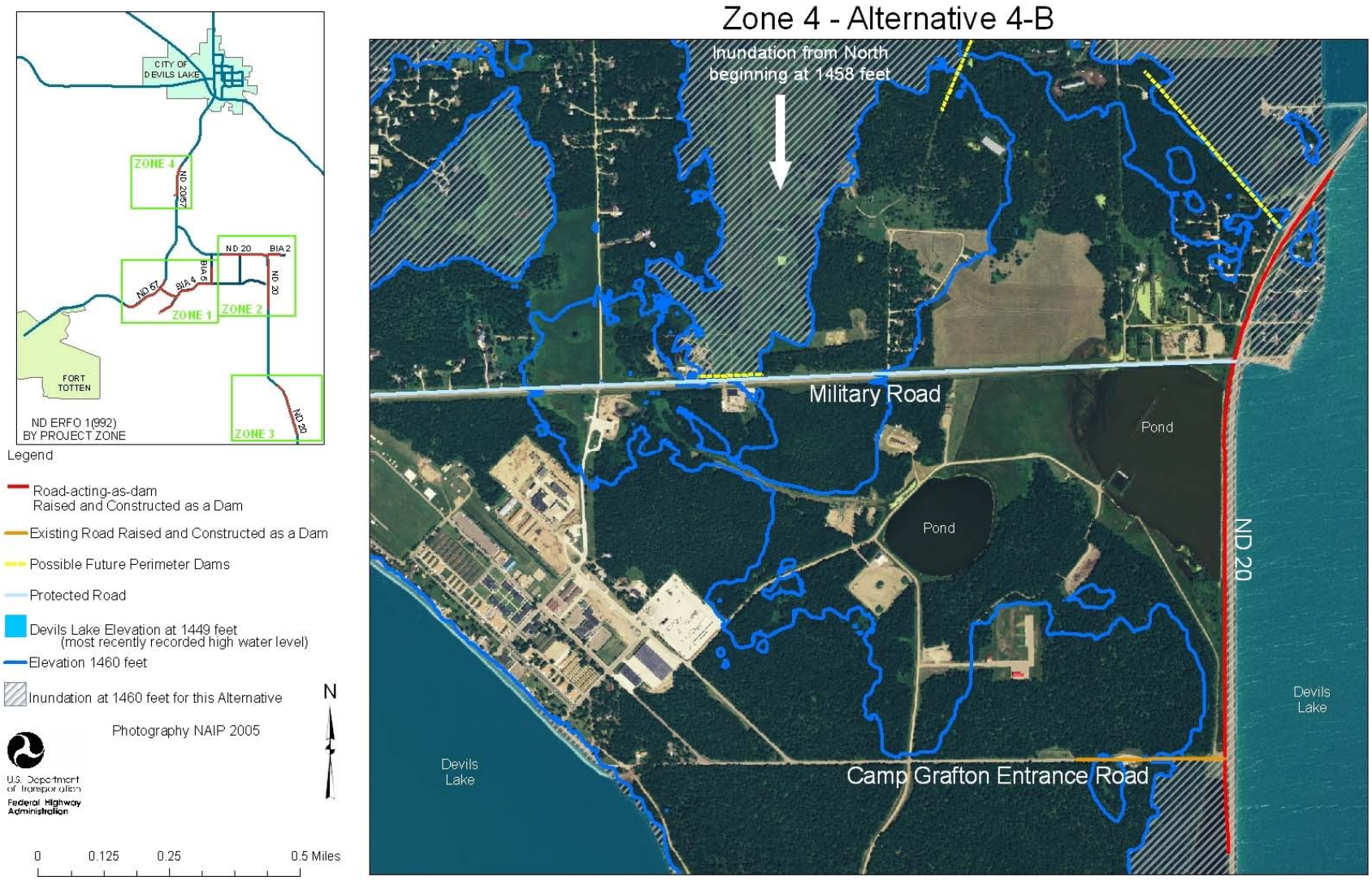

Figure 2-13. Zone 4 – Alternative 4-B

would be constructed by others and may not be needed depending on the Devils Lake levee system that will be constructed. Given the uncertainty regarding the future need for the three dams and the fact that they would be constructed by others, they are not included as a part of the proposal for Alternative 4-B.

This alternative provides the added benefit of protecting a residential area to north of Military Road and west of ND 20 and the Camp Grafton facilities. The disadvantage associated with this alternative is that it maintains ND 20 as a dam, thereby requiring monitoring and approval from dam-building agencies for future work should federal funds be used. The preliminary cost estimate to build this alternative to an ultimate elevation of 1,468 feet is $38 million. For purposes of comparison, including the construction of the three additional dams would raise the cost to approximately $39 million.

C. Design Considerations for Build Alternatives

1. Typical Sections

A "typical section" shows what the dimensions of the road or dam should be upon completion of construction. Typical sections are developed to ensure that the roads or dams they address are uniform in design. The proposed dimensions of a roadway are based on a number of factors including roadway classification, the speed for which the road is designed, the size of the vehicles, and the amount of traffic anticipated to use the road. ROW required for any of these dams or roads could be as great as 300 feet in width. For the existing roads and dams, much of this width is already included within the existing roadway ROW.

For purposes of this document, the typical sections presented here are those needed to construct the roads or dams to the ultimate elevation of 1,468 feet. As discussed in the *Introduction* under "Phased Implementation," it is likely that, due to funding limitations, interim grade raises would be constructed initially. As a result, only a portion of the typical section would be constructed under each phase until the ultimate elevation would be reached.

Based on this information, the following are the typical sections for the roads and dams addressed in this project.

a) ND 20 in Zone 4 and ND 57

The widths identified in the typical sections for these roads are the same whether they are equalized or constructed as dams (**Figures 2-14** and **2-15**). They have two 12-foot lanes with two eight-foot shoulders. Beyond the shoulders, there is an additional 22 feet of clear zone that is maintained for safety purposes.

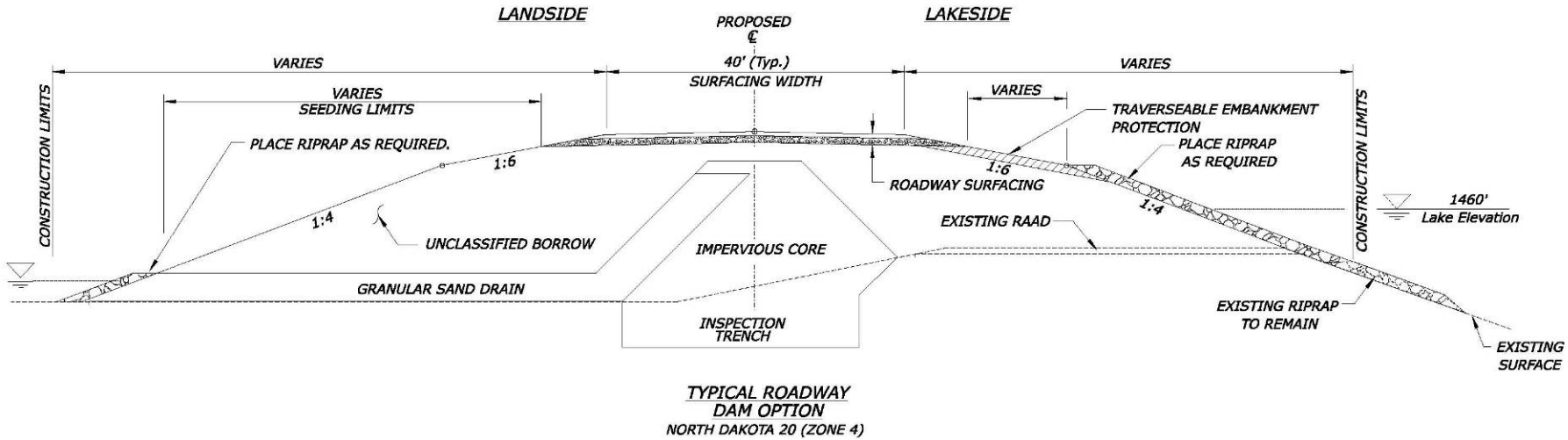

Figure 2-14. Typical Section for Building ND 20 as a Dam in Zone 4

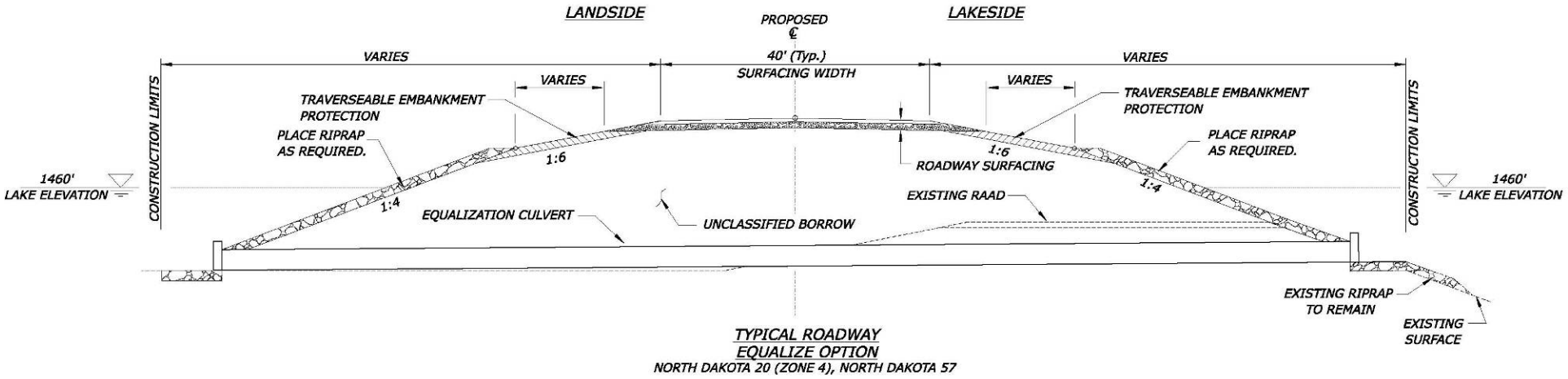

Figure 2-15. Typical Section for Equalizing ND 20 (Zone 4) and ND 57

b) BIA Roads 1, 2, 4, and 5, Military Road, Camp Grafton Entrance Road, and ND 20 in Zones 1, 2, and 3

The dimensions identified in the typical sections for these roads do not vary depending on whether they are equalized or constructed as dams (**Figures 2-16** and **2-17**). The typical section for these roads consists of two 12-foot lanes and shoulders that vary in width, depending on roadway classification, traffic volumes, and speed, from zero to three-foot shoulders. Where these roads are surfaced in gravel, there would be no demarcated shoulders. Beyond the shoulders, there is an additional 9-23 feet of clear zone, depending on traffic volumes and speed, maintained for safety purposes.

c) All Perimeter Dams (Zones 1, 2, and 3)

The typical section for all of the perimeter dams consists of a 20-foot-width top (**Figure 2-18**). These dams are not intended to carry public traffic, only maintenance vehicles, so they do not have the features normally associated with roads such as lanes, shoulders, travelways, and clear zones and, as a result, are narrower than roads.

D. Alternatives Considered but Dismissed from Further Analysis

1. Construction of Outlet or Lowering the Natural Outlet

This alternative involves the construction of an outlet or the lowering of the natural outlet to below 1,459 feet to allow Devils Lake to flow into the Sheyenne River. This alternative is expressly prohibited in the SAFETEA-LU funding language for this project. However, under NEPA, an alternative cannot be dismissed from analysis due to congressional directive. In this case, this alternative is dismissed because the FHWA has determined that this alternative is outside of the scope of this document. The purpose and need for this project is to address safety hazards currently posed by the RAADs, which are found only in the Acorn Ridge and St. Michael area; it is not to solve the greater issue of the rising water level in Devils Lake. Although creating an outlet *would* reduce the water in the Lake, thereby protecting the transportation network, the outlet of Devils Lake has proved a complicated issue, involving downstream impacts and numerous stakeholders, including the Canadian government, and extensive permitting from the USACE. There is a basin-wide task force established by Senator Byron Dorgan's office that may investigate this alternative and formulate further considerations.

2. Replace RAADs with Causeways or Bridges

This alternative would involve replacing the RAADs with long bridges, or causeways. Causeways are commonly used in areas like Florida, where roads connect strings of islands. For this project, ND 20 in the Spring Lake area might be a candidate for a causeway. The water would be able to flow under the causeway and would have similar inundation effects as raising the road and equalizing it. However, a preliminary cost estimate indicates that this option would cost 100 percent more than raising and equalizing ND 20. Therefore, this alternative was eliminated from further consideration.

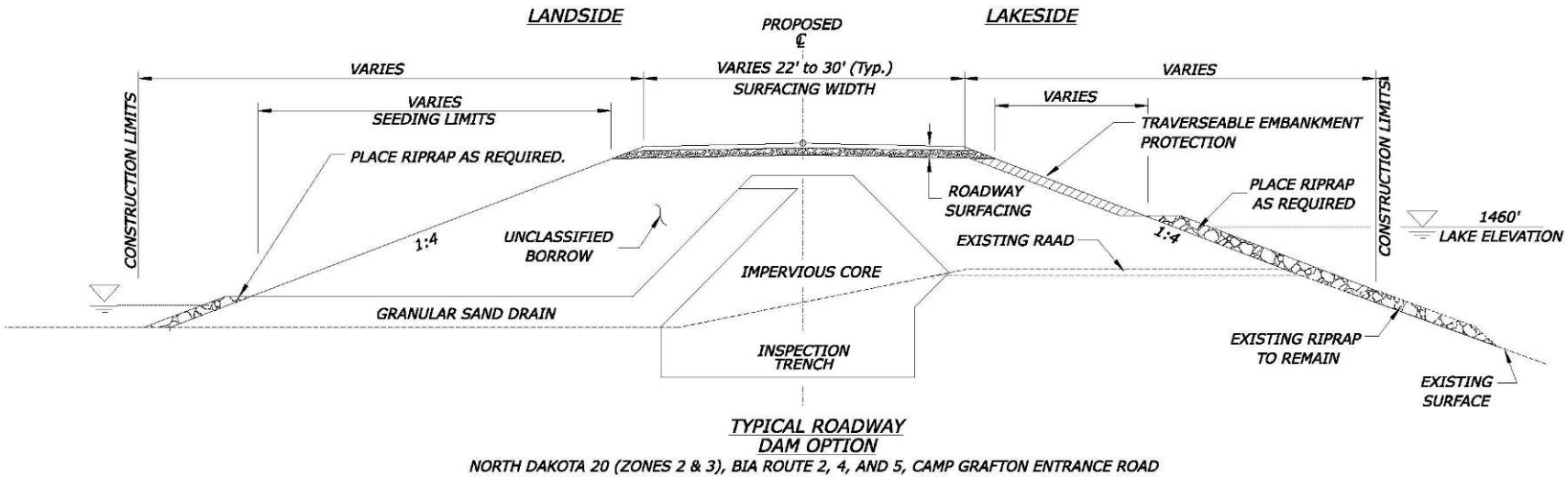

Figure 2-16. Typical Section for Building ND 20 (Zones 2 and 3) and BIA Roads 2, 4, and 5 as Dams

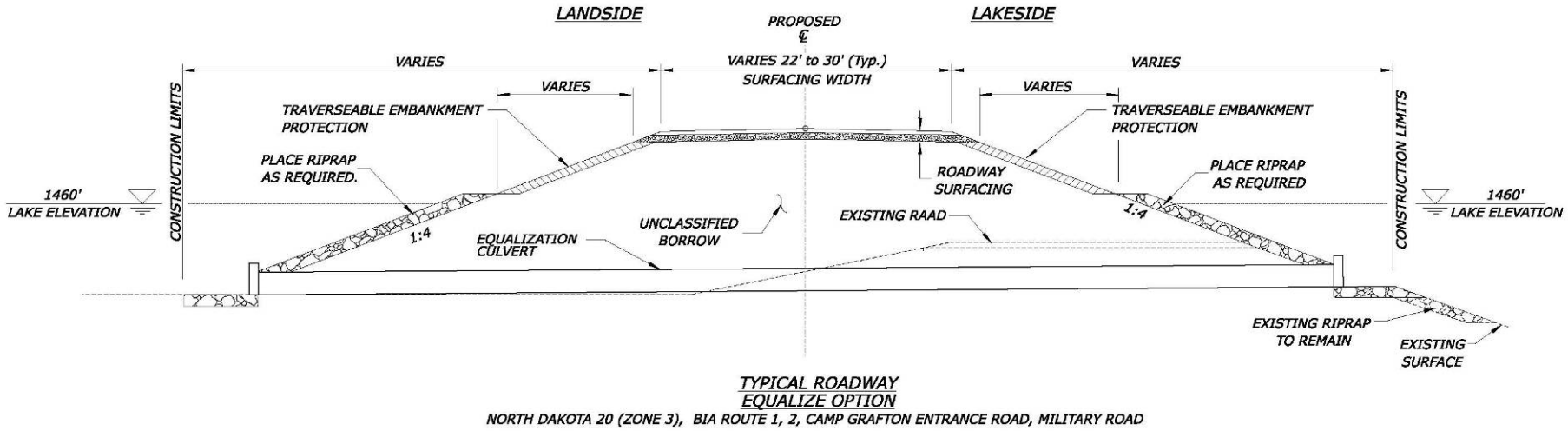

Figure 2-17. Typical Section for Equalizing ND 20 in Zone 3 and BIA Roads 1 and 2

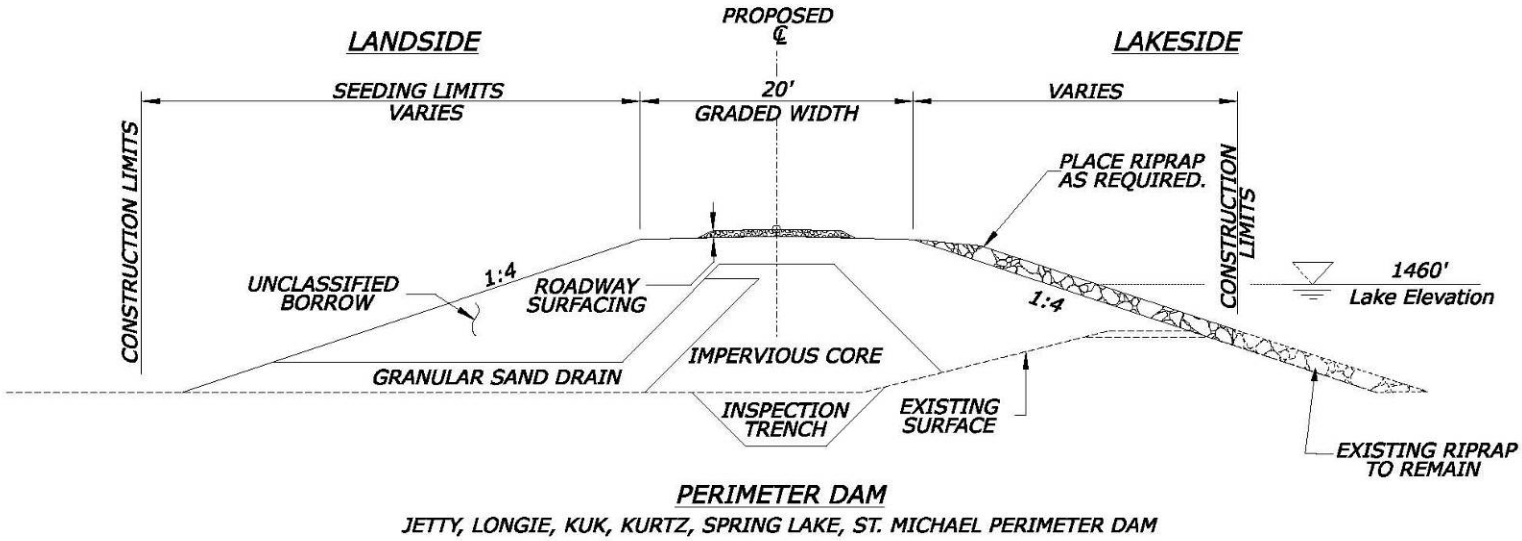

Figure 2-18. Typical Sections for Perimeter Dams

3. Construct BIA Road 1 as a Dam

This alternative was eliminated for a number of reasons. First, geotechnical reports have determined that the soils below BIA Road 1 are not suitable for water impoundment. In order to build BIA Road 1 as a dam, the entire structure would have to be reconstructed. Second, due to the poor soils, risk of an embankment failure during construction is high, since both sides of BIA Road 1 are currently located "in the wet" meaning that there is water on both sides. Reconstruction would create a considerable risk to the traveling public, the construction crews, and those currently protected by the structure. Third, there is presently a high-pressure water line running the length of the roadway prism. Because roads that hold back water cannot contain high-pressure water lines, the line would have to be relocated at considerable cost.

4. Equalize Portions of ND 20 and BIA Roads 4 and 5

Equalizing ND 20 from BIA Road 2 to its intersection with BIA Road 4 and equalizing BIA Roads 4 and 5 would flood the interior transportation network, creating additional transportation needs that would have to be addressed—possibly on a broader scale and at a greater expense than the alternatives currently being proposed. Because this alternative threatens other components of the transportation system, which is not consistent with the purpose and need set forth in Chapter 1, it was eliminated from further consideration.

5. Construct ND 20 as a Dam from BIA Road 5 to High Ground South of BIA Road 4

In Zone 2, one of the options considered was to construct ND 20 as a dam from BIA Road 5 to about one mile south of BIA Road 4. Due to the expense associated with constructing this portion as a dam, and the fact that this section of road would require additional monitoring and maintenance, it was eliminated from further consideration.

6. Construct ND 20 as a Dam near Spring Lake

The water elevation of Spring Lake is, at times, higher than Devils Lake; therefore, Spring Lake drains toward Devils Lake. Perpetuating this condition by raising and constructing ND 20 as a dam could actually raise the water elevation of Spring Lake above 1,460 feet because there is no outlet for Spring Lake. Unless a pumping system is installed, this alternative would cause flooding to the interior transportation network as well as lands and residences. This alternative was eliminated because of the costs associated with building and maintaining a pumping system and the additional impacts this alternative could have to the interior roadway system.

7. Construct Parallel Dams

This alternative would involve the construction of dams on the landward side of the RAADs. The dams would run parallel to the road at the ultimate elevation of

1,468 feet. This alternative would permit the RAADs to be raised and equalized because the parallel dam would perform the function of holding back water. Since the roads would have to be raised in addition to the construction of additional parallel dams, this option would require a much greater amount of material and higher construction costs than the other build alternatives. In addition, both raising the road and constructing a parallel dam would create a large footprint, increasing impacts and requiring substantial additional ROW. Given the additional impacts and costs associated with this alternative, it was eliminated from further consideration.

8. Perform Construction on the "Wet Side" Rather than on the "Dry Side"

When performing work on existing perimeter dams and RAADs, construction activities can occur either on the landward side (dry side) or on the lakeside (wet side). In the Devils Lake environment, construction on the dry side impacts more wetlands because the wet side typically consists of deep water habitat rather than wetlands. Under Section 404 of the Clean Water Act, the FHWA is required to avoid and minimize wetland impacts to the extent it is logistically and technologically feasible, is not cost prohibitive, and does not incur other considerable impacts to the environment. To reconstruct roads, RAADs, and perimeter dams on the "wet" side would require the construction of cofferdams in deep water and dewatering of the area prior to construction. This is technically challenging and would involve additional cost and time. Although it may slightly increase wetlands impacts, building on the dry side results in fewer overall impacts to waters of the U.S. Given these considerations, constructing on the "wet" side of the dams has been eliminated from further consideration.

9. Realign ND 20 in the Spring Lake Area

This proposal involves realigning ND 20 so that it would avoid extending through Spring Lake by following BIA Road 21 west until it intersects with BIA Road 16 at which point it heads north (**Figure 2-19)**. After it passes BIA Road 17, it would extend east cross-country and would tie in with the original ND 20 alignment just north of Spring Lake. While this alternative had the advantage of removing the road from the vicinity of the rising waters of Devils Lake and Spring Lake, it was eliminated based on socioeconomic and logistical concerns. Currently, BIA Road 21 bisects the community of Wood Lake to the south from the town of Tokio to the north. Tokio has a recreation center, a store, and a church, all of which are accessed by residents of Wood Lake. Most recent traffic data indicates that the daily traffic is at a volume of 1,266 vehicles per day. At this volume, BIA Road 21 does not pose any severe safety concerns to residents crossing the road to access these community services. However, if ND 20 were to be realigned along BIA Road 21, this would increase the traffic by almost 2,000 vehicles per day to approximately 3,266 vehicles per day, an increase by almost 250 percent, and creating safety concerns for pedestrians crossing the roads.

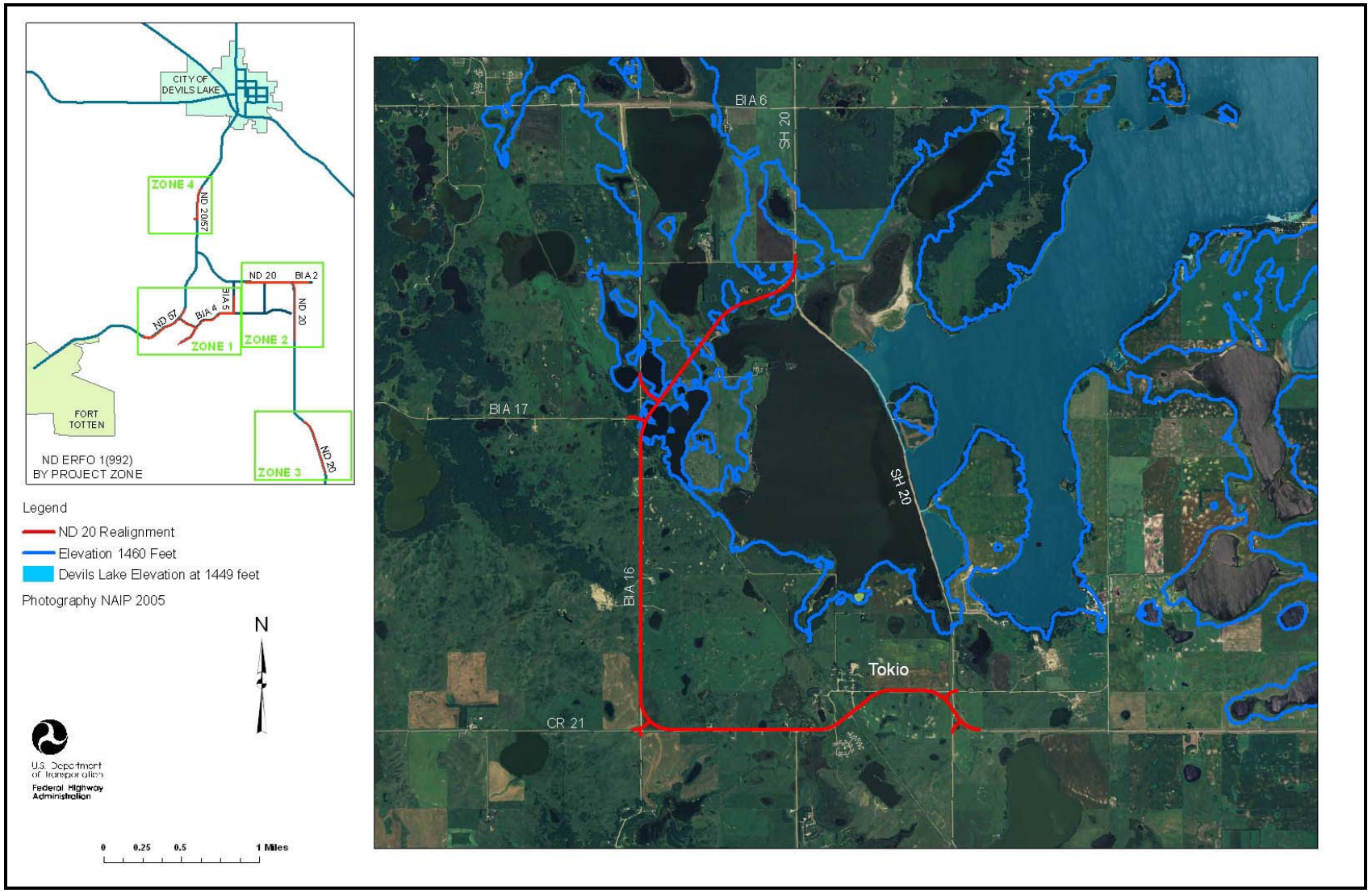

Figure 2-19. ND 20 Proposed Alignment

Another socioeconomic consideration is that by routing ND 20 along BIA Roads 21 and 16, this would provide the State of North Dakota jurisdiction over lands that presently belong to the SLN. In the context of lands and roads, the SLN has expressed concern over how much the Tribe has already lost due to the rising lake waters. The SLN views this proposal as further abrogation of their sovereignty over their lands. Two petitions opposing the realignment were circulated and members of the SLN have stated that they would not willingly sell land that would be needed for ROW. The SLN is a sovereign nation and retains control over their lands. Since they have stated that they have no interest in pursuing sale or transfer of lands for this alternative's ROW, this alternative is not practicable. As a result, this alternative was eliminated from further consideration.